balloons; 3) we always employ postprocedure intravascular ultrasound to confirm stent expansion and apposition; and 4) we routinely use glycoprotein IIb/IIIa inhibitors in the absence of significant bleeding risk.

Finally, before percutaneous coronary intervention for unprotected LMCA disease becomes the "worldwide standard of care," it is imperative that further studies define the optimal stenting strategy based on specific lesion characteristics and also determine whether restenosis of the left circumflex ostium has a benign prognosis if left untreated. This truth is self-evident: all left main lesions are not alike, and they should not be treated as equals.

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Can Technical Limitations of Strain Rate Imaging Be Overtaken by Particular Arrangements?

The present letter concerns the State-of-the-Art Paper by Marwick (1) published in the April 4, 2006, issue of the *Journal*. The clinical impact of this report is valuable because the potentiality of Doppler echocardiographically-derived strain rate imaging (SRI) is often emhpasized, whereas the technical limitations are not always shown. The illustrations, derived from a reference group for this methodology, clearly demonstrate sources of pitfalls and misinterpretations due to either wrong recording or measure of SRI.

In our experience, at least 2 of these technical limitations may be overtaken or blunted by arrangements performed during imaging recording and/or off-line measures. First, the noisy signal of SRI (especially of strain rate) can be drastically reduced by very high frame rates of color tissue Doppler recording. Modern machines are certainly able to provide frame rates ≥100 frames/s. However, the highest frame rates are obtained with the narrowest scan of a given, isolated wall. By this modality, frame rates >250 frames/s (even >300 frames/s in the last-generation equipment) can be achieved, with consequent optimization of both strain and strain-rate measure. The obvious price to pay for this operation is the loss of visualization of the overall ventricle and the consequent need to separately assess the various left ventricular (LV) walls. In the absence of regional wall motion abnormalities and/or focal cardiac pathologies, the wall with the best imaging quality (e.g., posterior septum or inferior wall) may be chosen as a reference region of interest. The consequent quantitative information may be extrapolated to the overall myocardium, both at rest and during pharmacological response to dobutamine, to assess the functional state and the inotropic reserve, respectively.

In addition, the possible inappropriate timing of the different phases of the cardiac cycle may be overtaken. The application of SRI implies per se a correct identification of systolic and diastolic time intervals. This aspect is crucial for the assessment of myocardial dyssynchrony, when a postsystolic motion, occurring during a prolonged relaxation time, might be confused with the normal systolic contraction. This may be avoided by marking end-diastole and end-systole on previously recorded pulsed Doppler imaging of mitral inflow and LV output flow, respectively. In the last-generation machines, by using this method, markers of mitral valve opening and closure as well as markers of aortic valve opening and closure are automatically superimposed to SRI (2). Alternatively, systolic and diastolic time intervals can be identified by the method proposed by Voigt et al. (3): LV end-systole (i.e., the aortic valve closure) is derived by color tissue Doppler superimposed to M-mode, as the end-systolic thin blue line, which, caused by a brief backward motion of the mitral valve secondary to aortic valve closure, is visualized within the otherwise red-colored mitral anterior leaflet. This method is, however, complex and difficult to apply in the clinical setting.

Nowadays, SRI remains a tool useful for research purposes more than for clinical application. Nevertheless, some information about refinements and arrangements during recording and reading of the examination may lead to a more appropriate use of this tool.

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REPLY

We appreciate the interest and commentary of Dr. Galderisi concerning my report (1). His suggestions may help with the avoidance of artifact, but they may not be sufficient to make this technique a standard clinical tool. Narrow sector imaging certainly permits acquisition at a high frame rate, while maintaining a high

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number of Doppler beams across the image (and therefore spatial resolution). Unfortunately, this does not remove the problem of signal noise, and the narrow sector prevents visualization of the contralateral wall, which is vital during stress echocardiography or other regional analyses for comparing the timing and magnitude of contraction. Similarly, the use of blood-flow Doppler to position timing markers is a worthwhile step to optimize timing, but may be misleading if the heart rate changes, and this approach reduces feasibility by requiring another step during the acquisition. Dr. Galderisi's suggestions to improve the reliability of strain-rate imaging reinforce our belief that the critical component in the current iteration of this technique is a thoughtful physician or sonographer to acquire and process the images. Although this can be expected in the research laboratory, the availability of such a person with the time to do this is less certain in a busy clinical laboratory.

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